



# Safety at the Sharp-End: A Case Study in the Gas Sector

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**ABSTRACT:** Not only have risks become fundamentally unique and unpredictable, they also cannot all be anticipated when work is planned. Some risks can only be managed when they occur, by those who are facing them on the ground when they occur, most often field operators. These workers must have the capacity to identify, analyse and make decisions in order to avoid a deterioration of the situation. However, such capabilities are generally expected of managers, rather than field operators. Our working hypothesis therefore relates to this “managerialisation” of technical staff, and what it actually means in terms of professionalism and the relationship of both field workers and their supervisors to their work. This paper examines the tensions that underlie this managerialisation. It summarises the results of an initial phase of exploratory research and presents the theoretical and methodological approaches that will be implemented in subsequent work.

## I. Introduction

This paper explores the safety culture and safety results of a large company operating in the gas sector. Indeed the implementation of numerous procedures, practices, trainings, etc. aimed at improving risk management and the safety culture of the organization has already allowed for important progress, but ground for improvement remains.

Our research focuses on the nature of the risks faced by the organization and its employees. In particular, it looks at operational workers who are most exposed to risk and at the measures put in place to manage these risks (managerial and technical tools, training, awareness-raising campaigns, etc.). A review of business practices and individual interviews that were carried out during an exploratory phase of the project established a contradiction between what the organisation needs to manage risk and the risk management system that has been implemented. Indeed the management of fundamentally complex and unpredictable risks requires a proactive attitude on the part of field workers, which enables them to identify, analyse and manage risks as they arise. However, the system implemented by the organization encourages a passive attitude, and reliance on supervisors to manage unexpected events. Our working hypothesis is that this contradiction between active and passive attitudes may explain the stagnation in the organisation's safety performance and that an analysis of the underlying origins may identify drivers for progress.

This paper presents the results of earlier work that led to the identification of this contradiction and explores the tensions between active and passive attitudes. It first describes the industrial partner and the specific target population. It then outlines the working hypothesis and presents the results obtained during this exploratory phase of the project. Finally it presents the theoretical and methodological approaches that will be used in the next phase of work.

## II. Exploratory work

### *The industrial partner*

Our research is carried out in partnership with a large industrial gas distribution company, which is responsible for the delivery of natural gas from the transport network to the end-user (households or companies).

To do this, it must maintain nearly 200,000 km of pipeline. This involves: monitoring the status of the network and carrying out any maintenance operations that are necessary to avoid leaks; connecting new customers (network expansion, installation of regulators, creating connections); disconnecting parts of the network (removal of connections, regulators, sections of pipeline); and finally coordination with other companies whose activities may have an impact on gas installations (which include pipelines and associated equipment, regulators, individual or collective connections, storage cabinets, etc.). Such companies are typically other network operators

(electricity, water, telecommunications, etc.), and road-building or public construction companies.

Executing these activities exposes the company to ‘classical’ occupational risks (everyday risks, psychosocial risks, etc.); risks related to its construction activities (incidents and accidents resulting from technical operations, the use of tools, etc.) and risks specifically related to gas (fire, explosion, acoustic pressure, etc.). These risks may result from the activities of the company itself, from its sub-contractors (earthwork contractors, technical specialists, etc.) or from third parties working in the vicinity of the site.

The company’s core business of operating the gas distribution network is organised into four operational units:

- Project design and network management;
- Project implementation and maintenance operations;
- Organization/planning of human resources; and
- Management of work carried out by third parties (local authorities, operators of water/electricity networks, individual households, etc.) in the vicinity of the distribution network.

These activities are all crucial to gas distribution and they cannot be separated when considered under an operational perspective. Yet at the administrative, financial, human resources and even geographical level they are clearly separated.

### *The target population*

Our project focuses on only one of these areas, namely, project implementation and maintenance operations, i.e. the actual execution of work, which is both the most technical activity and the most directly exposed to industrial and individual risk. We chose to focus on this specific activity as it is the one closest to the company’s historic core business, and because it is the one most directly exposed to risk.

Employees that perform actual work on the ground are termed “field workers” or “operational workers”. They carry out on-site interventions (connection, disconnection, extension, removal, modifications, etc. to pipelines) and maintenance operations (checks of regulators, network valves, etc.).

The trade initially required strong technical competence in plumbing: interviews carried out in the exploratory phase showed that a “good gas

technician” was one who had excellent technical competence and “got the day’s work done”. They were expected to know how to execute technical operations, on schedule – the important thing being the final result.

Over the past ten years the trade has undergone profound transformations. This is the combined result of technical progress, changes in the company’s business model (in particular an increased reliance on outsourcing), much greater regulatory pressure and several accidents. The latter have left their mark on company culture and pushed it to make safety a challenge that is fully integrated into the business of gas distribution. The main consequences of these changes are:

- A decline in construction projects requiring plumbing or specific gas-related skills, that goes hand in hand with an increase in routine maintenance requiring fewer technical skills;
- The increasing use of new technologies in the field (not only PDAs and telephones but also for example, electrofusion welding machines, which replace manual welding) and in the office, as there is an increase in the amount of meta-operational work (Falzon, 1994);
- Increased meta-operational work, both in terms of procedures and management. More time is needed to understand procedures and operating modes, to obtain administrative authorizations, prepare reports, etc.

Field workers are under the hierarchical responsibility of supervisors here termed “direct” or “front-line” supervisors. The function of these supervisors is, literally, to supervise the execution of work, i.e. brief/debrief field workers, monitor the smooth execution of work on the basis of paperwork filled out by field workers and manage the team (issue sanctions, coordinate absences, etc.). Field workers usually turn to them when they encounter unexpected situations, especially when the problem relates to logistics (lack of equipment, transport problems, etc.) or administration (a pipe that needs to be excavated, work that is running behind schedule, etc.). A running joke among supervisors (heard during observations and interviews) is that they are the “mummies” of operational workers – interestingly, one of the few aspects of the trade which seems to remain permanent over time and can be observed in “ancient” workers as well as with the younger ones. Finally, it should be noted that the role of supervisors is above all hierarchical and managerial. Technical preparations are the responsibility of other staff, known as “preparers” who have no hierarchical

relationship (nor substantial interpersonal relationship) with operational staff.

Therefore, it is these two groups, operational staff and their immediate supervisors that lie at the heart of our research. Our objective was to observe each group individually in order to understand the relationship that unites them and examine their relationship to risk management. In order to achieve this, an exploratory phase based on non-participant observation and individual semi-structured interviews was implemented.

### *Provisional working hypothesis*

Before looking at the operational aspects of gas distribution, observation began with a period of immersion at the headquarters of the industrial partner, which made it possible to quickly become familiar with the organisation's challenges and culture. It offered the opportunity to carry out formal and informal interviews with managers and technical experts, to take part in meetings, and to review documentation related to gas distribution, with particular interest for procedures-related documents. The immersion was carried out in parallel with an initial literature review of the concepts most central to the research project, including safety culture, risk and management.

Iterations between empirical observations and literature review helped progressively narrow the research object and formulate an initial hypothesis. This postulates that the managerialisation of field workers is essential for successful risk management. Managerialisation is expected to lead to the restructuring of the trade of both gas technicians and their supervisors. It suggests that supervisors should partially give up their traditional responsibilities, these that will be endorsed by field workers directly on the field when they manage risk, and instead support teams in the development of these new skills.

The hypothesis was based on a generally accepted assumption that risks are now pervasive, chronically unpredictable and cannot be fully and completely or comprehensively anticipated when work is planned (see e.g. Beck, 2001; Pécaud, 2010; Kermisch, 2011; Mignard and Terssac, 2011).

Therefore when unforeseen risks arise in the workplace it is up to field workers to identify them, analyse their inputs and outputs and take appropriate decisions. One of the keys to risk management lies in their ability to react quickly to avoid a deterioration of the situation (Knegtering

B., Pasman H.J, 2009). From this perspective, the time it takes to call a supervisor (if they can be reached) and describe the situation (with a risk that something is missed, misunderstood or misrepresented) so that someone who is removed from the situation can take responsibility for making a decision seems both an expensive waste of time and inherently risk-bearing (not only for the supervisor who must make a decision, but also for the field worker who may find themselves accused of providing the wrong information). This analysis, which forms the basis for our work provides a very good illustration of the limitations of this mode of operation, as this is how most risk situations are currently managed, but it has notably failed to reduce the number of incidents and accidents.

Effective risk management is therefore based on the ability of field workers to go beyond their role of simply carrying out instructions. Instead they need to adopt a proactive attitude of active attention to their environment, think about context analyses and make reasoned decisions. However, such attitudes and skills are traditionally expected of managers (Mintzberg, 1984), not technicians.

### *Methods*

It quickly became clear that non-participant observation and semi-structured interviews were the best way to test the hypothesis.

Non-participant observation was chosen for the opportunity it provides to experience the social reality of the group, its dynamics and to see life as it is lived. It avoids the filter of discursive constructions and makes it possible to capture simultaneously and in all their complexity the technical and cognitive practices of agents (Arborio & Fournier, 1999; Thiétard, 2007).

The method involved making direct observations of the way in which projects are "framed" at briefings (i.e. the information volunteered by the supervisor, additional information required by the field worker); the behaviour of workers as they prepare for work; what happens when they arrive on-site; their subsequent behaviour throughout the duration of the operation; what provoked discussions with colleagues (employees usually worked in pairs) and potentially supervisors; the nature of these discussions (topics, atmosphere...); and the nature of potential constraints that could emerge, etc. These practical aspects of the trade are difficult to capture during interviews as they may be unconscious, forgotten, retrospectively distorted, etc.

In order to minimise biases related to local situations (i.e. impact of a manager's personality on the working environment, weight of a specific local history / context, etc.) and in response to a request from the industrial partner, this phase consisted of the observation of three operational sites in three different regions.

As a complement to direct observations, thirty semi-structured interviews were conducted with field workers, direct supervisors, preparers and managers (managers have overall responsibility for operational sites and their main function is to manage front-line supervisors).

The aim was to gather data on the daily life of employees and to develop an understanding of how they perceive it. Initially this concerned experiences at team level and the identification of challenges encountered by individuals within their peer group (i.e. by each field worker with respect to other field workers, and each supervisor with respect to other supervisors), and the challenges encountered by each group with respect to the other. Secondly, it looked at experiences and the risks encountered at a professional level, again with the aim of understanding the relationship of each group to risk, and to identify any potential differences in attitudes to risk between the two groups.

This exploratory phase of the project resulted in the collection of an initial dataset and the specification of the research hypothesis.

### III. Results

The first phase of field observation supported the initial working hypothesis. This postulated that in the actual working situation unexpected events frequently emerge, which field operators must immediately manage if work is not to grind to a halt and to prevent risk from deteriorating.

For example, it is common for "excavations" (the exposed area surrounding the place where work on the gas network is carried out) prepared by external contractors to be unsafe, usually because of surrounding debris (which, according to the company's procedure, should be bagged and stored away from the excavation to prevent landslides) or pieces of metal that protrude from the walls of the excavated area (which can injure employees). Other problems include discovering once on site that the section of piping on which work has to be carried out is not of the

diameter/material identified during the preparation phase and that they are therefore not equipped with the proper tools, which obliges workers either to collect the correct equipment themselves, or to cobble something together with unsuitable equipment.

At first sight such circumstances may not seem seriously or inherently risky. However, at a minimum they disrupt normal operations and may create pressure (stress, shorter deadlines) that diverts attention from other risks, thereby constituting accident-provoking factors; also in the perspective of human & organizational factors (Reason, 2013), those are the type of factors that may lead to human errors and therefore contribute to accidents. Moreover, they require employees to mobilise skills such as managing relationships with service providers who have prepared the excavation (notably if they are still there, to get them to improve the situation or to train them in order to prevent recurrence), to make trade-offs and make decisions (notably regarding time that is lost in collecting equipment and in the use of non-compliant materials).

Nevertheless, it appears that field workers request the help of their supervisors as soon as an unforeseen situation is identified. The exceptions were a few isolated cases where a supervisor could not provide a solution (e.g. when a torque wrench required for the installation of a gas meter could not be used due to a lack of space around the counter). Typically, field workers describe the situation to their supervisor and expect to be told what to do. In turn, supervisors sometimes decide to go and see the situation for themselves – either because they do not trust what has been reported to them, or because they deem it necessary to resolve the situation in person.

However, the unpredictability of risks and the need to manage them immediately remains a very real problem, as demonstrated by the results of the first phase of the observation.

This observation of a discrepancy between what seems to be necessary to effectively manage risk (i.e. the managerialisation of field workers achieved through the development of a proactive attitude to their environment and certain cognitive skills) and the current practice of remote management by supervisors, leads to an examination of the reasons for this discrepancy: why do field workers, when faced with an unexpected situation, prefer to act as spectators and operators rather than taking charge of the situation?

#### IV. Future work: theoretical foundations and methodological tools

##### *Risk management and employee attitudes*

The issue is all the more surprising given the mythical gas technician known as “Zorro” who emerged from interviews. According to this myth, usually evoked with nostalgia (even by the younger workers who haven’t actually practiced their trade in such a way), the gas technician’s trade traditionally required a mixture of technical expertise, a sense of public service, and courage in dangerous situations. This idea has disappeared in favour of a picture of the trade that is far more formal and sanitised, in which sticking to the rules and the precautionary principle take precedence. With such a mind-set, it is surprising that gas technicians do not seize any opportunity to return to more unsophisticated practices.

Consequently, we turned our attention to how the actions of workers are framed by the company (prior to, during and after they are executed), and how risk is integrated in this framing. This brought out the importance, at all stages of the project, of the technical and managerial tools used to monitor work, either through *a priori* framing or *a posteriori* reporting. We can only assume that the implementation of systematic checks at all stages of work ultimately led workers to conform to these control procedures, and consequently to develop an attitude of passive compliance. However, such passivity is inconsistent with the proactive attitude that our hypothesis suggests is required for effective risk management.

A further point to note is the way the organisation’s activities are currently set up. Current practices mean that field workers are issued with a work order without having participated in the planning of the work. There is therefore no opportunity for them to be consulted about technical solutions, constraints, potential risks, etc. Although this information is eventually made available, it is only after decisions have been taken and the project has been tied up. This leaves workers in a position where they are unable to ask questions and where they are only expected to execute specific actions of limited scope.

This contradiction between the proactive attitude required by the nature of risk and the passive attitude engendered by the organisation’s managerial and risk management systems helps in the identification of the challenges related to risk management.

##### *Theoretical foundations*

At the theoretical level, our hypothesis leads to an exploration of two avenues of research, one related to the conceptualization of what constitutes risk and the other to the rationale for the actions of employees.

Attempts to manage risk through procedures and compliance imply that it can be identified and supervised prior to any occurrence. This presupposes that risk exists in absolute terms (as it can be identified, named, categorised, anticipated, framed, etc.). However, many theorists (Beck, 2001; Pécaud, 2010; Mignard and Terssac, 2011; Kermisch, 2011; Kouabenan, 2009; Peretti-Wattel, 2005) agree that risk is an artefact, i.e. that it does not exist in itself but only in a specific cultural context that identifies it as such. Moreover, it appears to be fundamentally contingent, in that it only owes its “existence” (the occurrence of something that is initially only a possibility) to a specific configuration of events.

Risk management does not therefore involve soliciting the “right” response from employees who are faced with risk (i.e. a call to their supervisor or the application of the correct rule), based on an ultimately linear stimulus > response model. Rather it concerns the employee’s ability to be alert to their environment and to no longer view their working conditions in terms of a circumscribed domain (geographically, temporally, or technically) but rather as a set of dynamic, interacting phenomena, where inconsistencies may arise. It is these inconsistencies that lead to potential risk that must be monitored.

The prevalent systems’ perspective that is used to conceptualise risk is particularly put to the test by the rhizome model (Deleuze and Guattari, 1980). This is defined as “an asymmetric, non-hierarchical system, devoid of meaning (...) defined only as changes in states”. The concept seems to be a useful heuristic to address a complex phenomenon (risk), which is profoundly contingent in the sense that it does not have any meaning until its meaning is “decided” by an observer at a particular place and time.

In the same vein, we draw upon the concept of “practical reason” developed by Paul Ricœur (Ricœur, 1986, 1990). According to Ricœur, practical reason “identifies conditions of meaning for sensible action, where sensible action is that which an agent can understand”. Practical reason is based on four criteria: motivation, rationale,

attitudes and practical thinking. It seems particularly relevant to the analysis of the actions of field workers in their own terms using their own configuration and dynamics (and no longer simply in terms of their relation to procedures and external constraints). At the same time it relates these actions to the context (notably organisational) in which they originate. As Ricœur argues, practical reason can ultimately be defined as “all measures taken by individuals and institutions to preserve or restore the reciprocal dialectic of freedom and institutions, without which there is no sensible action”.

Given the complexity and specificity of risk-related action, which forms the basis for relationships to work, peer groups, supervisors, the company and actions themselves (as ultimately risk can turn into an accident), the ricœurien concept of practical reason appears to provide both an analytical framework for action and a rich conceptual framework.

### Methods

Our hypothesis, which postulates that the managerialisation of field workers is required for risk management, is actually divided into two sub-hypotheses:

- Sub-hypothesis 1: the very foundations of current risk management tools are unsuited to risk management, as they are the result of a concept of risk that sees it as an identifiable phenomenon that can therefore be framed upstream of its occurrence.
- Sub-hypothesis 2: the inadequacy of current risk management systems leads field workers to develop an attitude of the passive spectator, whereas effective risk management requires a proactive attitude.

The hypothesis will be tested in two phases:

- Further analysis of the organization's risk management system (taking into account both its content and its “shapes”, i.e. written/oral form, new technologies, etc.);
- Non-participant observation at one of the sites that hosted the first phase of observation;
  - Identification of successful risk management situations in order to carry out a more in-depth analysis with the actors concerned (via interviews) to identify the cognitive mechanisms mobilised.

- An analysis and classification of the motivation, rationale and attitudes used by field workers in risk management activities.
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### V. Conclusion

The second phase of the project will be carried out over the next nine months. It aims to develop a better understanding of what constitutes risk and how those employees who are most directly affected by these risks (re)act.

If this objective is achieved, it should be possible to improve risk management training for both operational staff and to help supervisors improve the support they provide to operational teams.

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